

Remarks

Claims 1-14 are pending in this application. Claims 1-14 now stand rejected. Claims 1 and 14 have been amended.

Claim Rejections – 35 USC § 103

Claims 1-2, 4, 6, 8, 10, and 12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US 4,498,909 to Milner et al. in view of US 5,901,653 to Jennebach et al., further in view of US 5,720,165 to Rizzie et al. and further in view of US 7,228,806 to Dueck et al. Claims 3, 5, 7, 9, 11, and 13 rejected under 35 U.S.C. § 103(a) as being unpatentable over ‘909 in view of ‘653, ‘165, and ‘806 as applied to claims 1, 3, and 5 above, and further in view of US 6,758,149 to Oiwa et al. Claim 14 is rejected under 35 U.S.C. § 103(a) as being unpatentable over ‘909 in view of ‘653, ‘165, ‘806, and ‘149.

In response to the Response to Arguments section on page 2 of the outstanding Office Action, Applicant has amended claims 1 and 14 to more explicitly state that the gasification boiler burns entire bales of straw at one time, and not piece by piece. Applicant has previously argued that the cited references, particularly ‘909, are not capable of burning an entire bale of straw, and certainly not effectively. Applicant’s arguments from the previous response are reproduced below for convenience, and the exhibits are of record.

Furthermore, Applicant respectfully disagrees with the Examiner’s characterization on page 2 of bales of straw as “fluffy fuels of low bulk density” as described in ‘909. On the contrary, bales of straw are highly compressed and bounded. In contrast to ‘909, which has a combustion zone within the main chamber, the invention of claims 1 and 14 has discrete gasification and combustion chambers. In the lower temperature gasification chamber, pyrolysis starts on the outside surface of the bale and works inward, with the heating gases being withdrawn by suction through the grate and into the higher temperature combustion chamber.

In addition, Applicant respectfully disagrees that the slag which would inevitably be formed by burning a bale of straw in the '909 gasification system would be properly removed by the ash plows 39. The slag would more likely form a solid roof on the grate and progressively arrest the combustion process.

Applicant's previous arguments from the response dated June 15, 2011 regarding the cited references inability to properly burn straw are reproduced below:

Milner does not teach a boiler capable of burning an entire straw bale, but rather teaches a boiler that continuously adds wood and/or wood chips as fuel. (Milner, Col. 1, line 60; Col. 2, lines 35-36; Col. 8, lines 14-15). The fuel is added through a valve 31 into a hopper 33, and then released into the chamber 20 on a continuous basis. (Milner, Col. 2, line 65 to Col. 3, line 14). The chamber 20 is therefore not configured to receive a bale of straw for burning all at one time and Milner teaches away from such a chamber. (See Col. 2, lines 34-44, the constant rate protects the equipment).

Furthermore, Applicant respectfully disagrees with the Examiner's assertion in paragraph 10 of the outstanding office action that because Dueck states that all kinds of biomass can be gasified, it would be obvious to use straw fuel with Milner. As stated in the background section of the present application, straw fuel poses particular problems for gasification, such as difficulty in achieving uniform gasification, low ash melting point, and high content of un-combusted small ash particles.

Attached Exhibits A-C (and translations) further discuss the difficulties of gasification of straw. As stated in Exhibit A, by 1997 wood gasifiers were considered "state of the art," while significant technical problems remained for straw fuel, partially due to higher levels of nitrogen, sulfur, chlorine, and alkalis. (Exhibit A, last paragraph of first page). Exhibit B states that straw has high ash content, a low softening interval, and high amounts of trace elements. (Exhibit B, "problem" paragraph). It further states that straw has up to 10x more ash, 4x more phosphorus, 10x more sulfur, and 100x more chlorine than conventional wood. (Exhibit B, "results" paragraph). Exhibit C, slide 3 states that straw has a 5-15x higher ash content than wood, that straw slags due to high alkali content at temperatures below 800°C, and that straw has higher levels of impurities such as nitrogen, chlorine, and sulfur. Exhibit C, slide 4 shows the relative amounts of impurities in straw (third column) compared to wood, expressed in multiples of wood.

One of ordinary skill in the art is aware of these problems and would not look to Milner, a wood chip boiler, for gasification of straw. Milner issued in 1985, twelve years before Exhibit A states that straw gasification still faces serious obstacles. In addition, Milner teaches using temperatures of about 1100°C to 1300°C, which are much higher than the melting points of salts present in straws (slag occurs at less than 800°C, as noted above in Exhibit C, and some salts in straw have melting points ranging from 300°C to 450°C). Using straw in the boiler of Milner would therefore result in significant slagging. In contrast to Milner, the invention of claim 1 avoids slagging by using large quantities of straw at a time, but at low temperature, resulting in a high quantity of fuel gas while avoiding the issues of slagging. It would also not be obvious to look to Milner because he teaches a boiler based on the reverse flow principle, while the present invention operates as a parallel flow gasifier.

Accordingly, Applicant respectfully submits that claims 1 and 14 are patentable over the cited references and requests the withdrawal of the rejection under 35 U.S.C. § 103(a) to claims 1 and 14. Claims 2-13 depend from claim 1 and are therefore patentable for at least the same reasons as above.

Conclusion

Applicant has made a genuine effort to respond to each of the Examiner's objections and rejections in advancing the prosecution of this case. Applicant believes that all formal and substantive requirements for patentability have been met and that this case is in condition for allowance, which action is respectfully requested. If any additional issues need to be resolved, the Examiner is invited to contact the undersigned at his/her earliest convenience.

Please charge any fees or credit any overpayments as a result of the filing of this paper to our Deposit Account No. 02-3978.

Respectfully submitted,

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